iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5383

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

A Score based Approach to Detect Drowsiness using OpenCV

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Abstract: ***The Drowsiness detection system uses python methodologies using libraries like OpenCV, PyGame, Haar Cascade files to detect drowsiness of a person where input is taken from a live video feed and given as input to CNN model. People drive on the highway all the time. Most of the drivers who travel long-distance suffer from a lack of sleep. So, in that sleepy mood it is very risky to drive especially at nights. Most of the accidents happen due to this sleepiness. So, to stop these accidents we built a system using Python which can alarm the driving force when they fall sleepy. The main aim of this Python project is to make a system that can detect a person's drowsiness accurately. One of the methods to detect drowsiness is to calculate the time for which person has closed their eyes by calculating EAR (Eye aspect Ratio) from each frame. In each frame the eye area is located and trained using the Haar cascade classifier. For every n frame score attribute is incremented. So, when this score reaches to maximum (which is set by the developer) an alarm in the form of beep sound is heard to which the driver wakes up. This system will alert the driving force when drowsiness is detected. Train the Convolutional Neural Network and your custom data set (the network is designed to handle class imbalance). Run to start a live video using your webcam.***

Keywords: Computer Vision, Haar Cascade classifier, Convolution Neural Network (CNN)

I. INTRODUCTION

About 40% of fatal accidents are due to Drowsiness among drivers according to Central Road Research Institute (CRRI) In a survey It is found that on an average majority of accidents take place between 3 pm and 6 pm and on midnight around 11 pm to 4 am. The statistics about the accidents are represented in the form of the chart shown in below figure Fig 1. Due to a lack of alertness in the driver caused by sleepiness, the ability to drive decreases. Besides, due to drowsiness, the ability to face a sudden situation/jerk decreases and leads to disasters that spares lives. Varying work timings, excess working, long-distance traveling, improper scheduling like late-night traveling leads to fatal errors of drivers which cannot be corrected. Face recognition is one of the most active research topics due to its potential applications in access control, automated crowd surveillance, law enforcement, information safety, multimedia communication, human-machine interface, etc. Compared to other biometric authentication technologies, face recognition has an obvious advantage that it does not need much cooperation from users. Just for the broad application foreground of face recognition, how to recognize fake faces is important. A weak biometric access control can be fooled with the help of a photograph of the legitimate user. This is the problem that live face detection intends to address.

The leading objective of this paper to give a solution with the systematic procedure to recognize the driver's drowsiness, and can alert the driver to take some necessary precautions. Certain observable factors we can take are the amount of time for which eyes are closed, expressions of the drivers, eye movement, movement of the head. The present system is a computer-based system that takes live video feed of the driver as input, where we focus on the eyes of the driver and checks for the eye closure time continuously. When the driver's eyes are closed a count attribute that tracks the eyes is incremented. When it reaches its maximum limit, the driver is alerted with the beep sound alarm. The various modules in this system are eye tracking, face recognition, Frame allocation, arranging beep sounded alarms

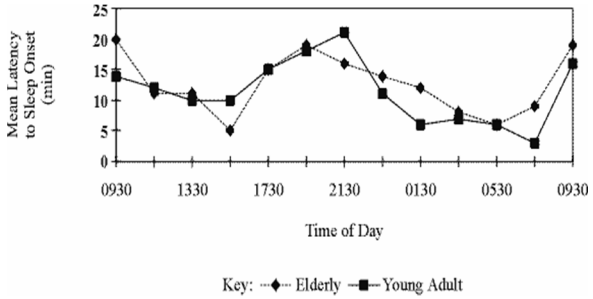


Fig 1: Survey Report

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II. LITERATURE

A real-time approach [1] in driver alertness which observes driver's eye movements and calculates EAR ratio for each frame of a video and consecutive frames are compared for EAR ratio. This EAR ratio is compared with the threshold value. If this EAR ratio is less in n consecutive frames then an alarm is generated. For capturing this live video of driver an IR camera is used which can detect eye movements even in dim light conditions. One can recognize drowsiness by observing the person's eyes by which we can determine the drive is awake or sleep In this paper [2], duration in which eyes closed and the blinking rate is determined. This technique mainly focuses on eyes continuously and alert the driver.

Using Haar cascade classifiers [4] any type of object can be detected. The system is trained using many positive and negative image results. Positive images mean one with the required object. Similarly, negative images mean one without the required object. In this scenario we assume face. Another system in which yawning is considered as the main indication for tiredness or sleepiness. The system recognizes the huge gap between the lips which is not similar to talking. In this system [2] we mainly focus on lip area and calculate the number of yawns the driver took in a continuous-time interval

Certain techniques [3] compare the eyes of the driver with the closed eye image. If both images match for a certain time interval then the driver is alarmed. It is an easy technique in which only image comparison is done. A productive system [4] observes eye characteristics, vehicle temperature speed in which the driver is traveling using a smartphone. Here they developed an application which is supported to both android and iOS. This approach not only observes drowsiness but also security problems of vehicle. In this work obstacles like hat worn by driver as well as glasses cannot affect the system. Using computer vision libraries and techniques fatigue in the driver is detected by observing eye irregular movement, eye closure, and frequent blinking

III.PROPOSED SYSTEM

In the proposed system extraction of eye area using OpenCV is explained. Later this extracted data is used in finding eye closure time by score incrementing process. Live video feed of the driver is given as input where it is divided into frames. Each frame is checked for eye area. Using eye positions from haar cascade files closure of the eyes is detected and comparison is done between consecutive frames. A video is formed by continuously displaying images. Usually a video speed is 16 frames per second. Each frame is extracted from the live video feed using OpenCV library and feed into the system model. If EAR is small for 15 consecutive frames then the score attribute is incremented. The score is incremented for every 15 frames. If the score reaches the maximum limit a beep sound is established using pygame library.

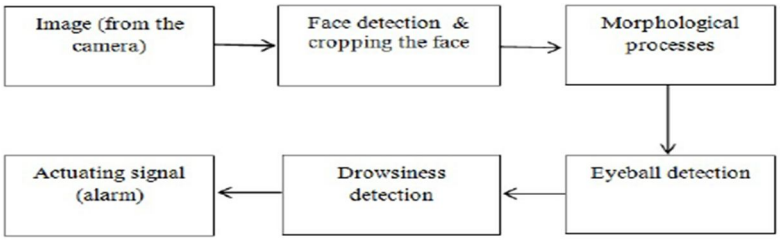


Fig 2: Architecture of Proposed System

Drowsiness detection is determined by calculating EAR ratio:

Let us consider few facial points which can be used to calculate the eye aspect ratio. Name these points as f1,f2,f3,f4,f5 and f6 as shown in the Fig 2.

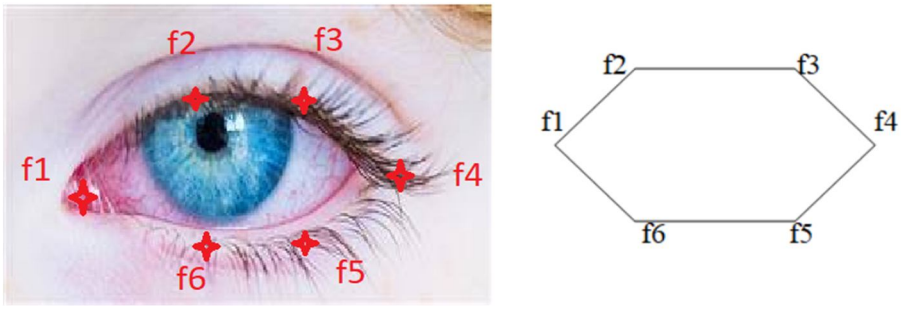


Fig 3: Location Of points on eye

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Where, distance between f1 and f4 indicates the distance between points that are horizontal to eye. Distance between f2 and f6, f3, f5 indicates the distance between points that are vertical to the eye. Overall vertical points distance is given by summing up of both vertical distances. In formula notation this can be written as,

$$\frac{\text{Distance between (f2, f6) +Distance between (f3, f5)}}{\text{2* Distance between (f1, f4)}}$$

To get the positive result we will apply modulus for this formula will be follows as

$$\frac{\text{Mod (Distance between (f2, f6) +Mod (Distance between (f3, f5)}}{\text{2*Mod (Distance between (f1, f4)}}$$

Here, we use Euclidian distance to find distance between two points. This formula allows us to calculate or monitor the state of the eye whether the eye is closed or opened using blinks of eye

A. Required libraries and tools

OpenCV (Open Source Computer Vision) is a software library used to do various tasks on images like reading and writing images, text-recognition, facial expressions in designing virtual reality applications. It is an open source library installed on command line using pip command. It can be implemented using various languages like python, c++, Android SDK, Java

PyCharm is a development editor for developing projects by author in python2, python3 using frameworks.

Keras is a python library used to build a machine learning model or neural network model which can be also used while building in R.

B. Algorithm

1) *Step 1:* Start
2) *Step 2:* Take Live video feed as input
3) *Step 3:* Using OpenCV library divide the video into frames
4) *Step 4:* Region of Interest (ROI) for face is obtained.
5) *Step 5:* Eyes are detected from the obtained ROI
6) *Step 6:* The obtained insights are given as input to the classifier
7) *Step 7:* classifier using EAR detects whether the eyes are closed or not.
8) *Step 7:* calculates score attribute, if it reaches maximum limit alarm is generated using pygame library.
9) *Step 8:* Stop

C. Flow Chart

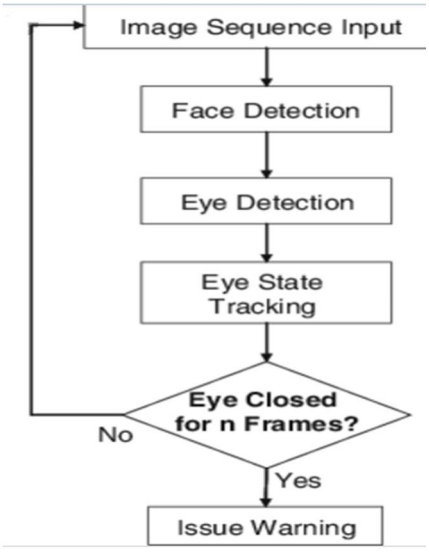


Fig 4: Flow Chart

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IV. PERFORMANCE ANALYSIS

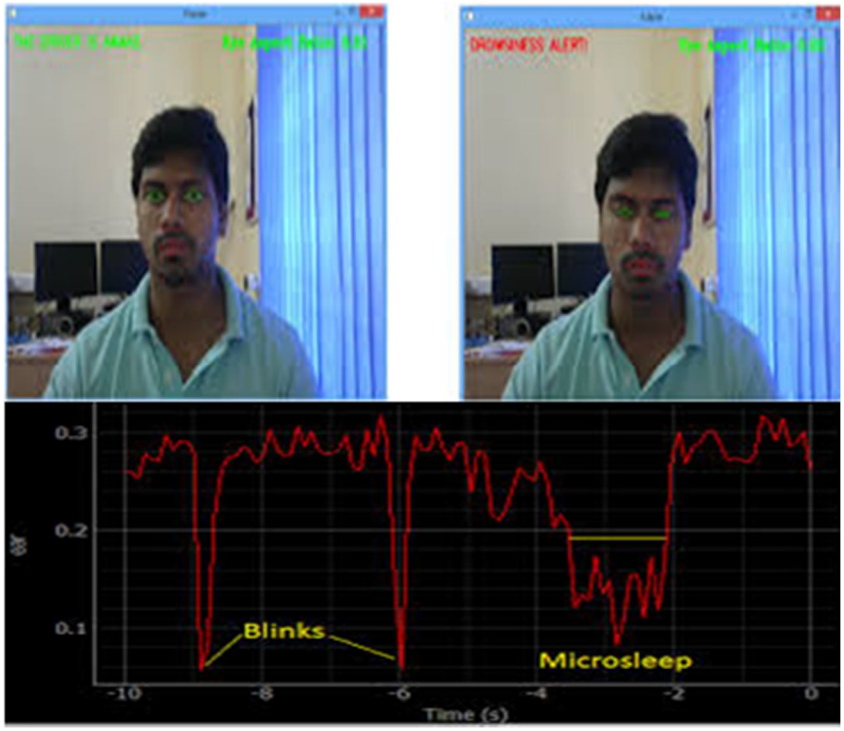


Fig 5: Observational Result under blinks and microsleep

V. CONCLUSION AND FUTURE SCOPE

The system we developed here is generally used to disclose the sleepiness or drowsiness of drivingforce in a very accurate and simple way. This is very helpful to avoid any type of misfortune while driving cars in mostly all situations and cases though if driver is keeping glasses and also in very dim light environment. During the observation one can conclude whether eyes are closed or not for certain time. If eyes of driver are closed for five seconds then the driver is alarmed with the beep sound which is generated using pygame library. Our system can avoid and decrease accidents which would protect the lives of many people. This can prevent injuries to cars and drivers, where too much focus is applied for the safety of driver and vehicle in usual and common cars also not only in opulence cars. As it provides enhanced security round the clock it can be extended to mobile applications where beep sounds are replaced by mobile alarms. In future it may centre on adoption of some factors like automobile circumstances, climatic surroundings, situations of sleepiness for exhaust quantification. The sleepiness will cause many problems to driver safeness. The most inhibitory consideration is to always keep track of or watch the tiredness of motorist to layout and dispense response on their state is very pivotal step. In present scenario no adaption for zoom is available so future work may spontaneously zoom on eyes whenever they are restrained.

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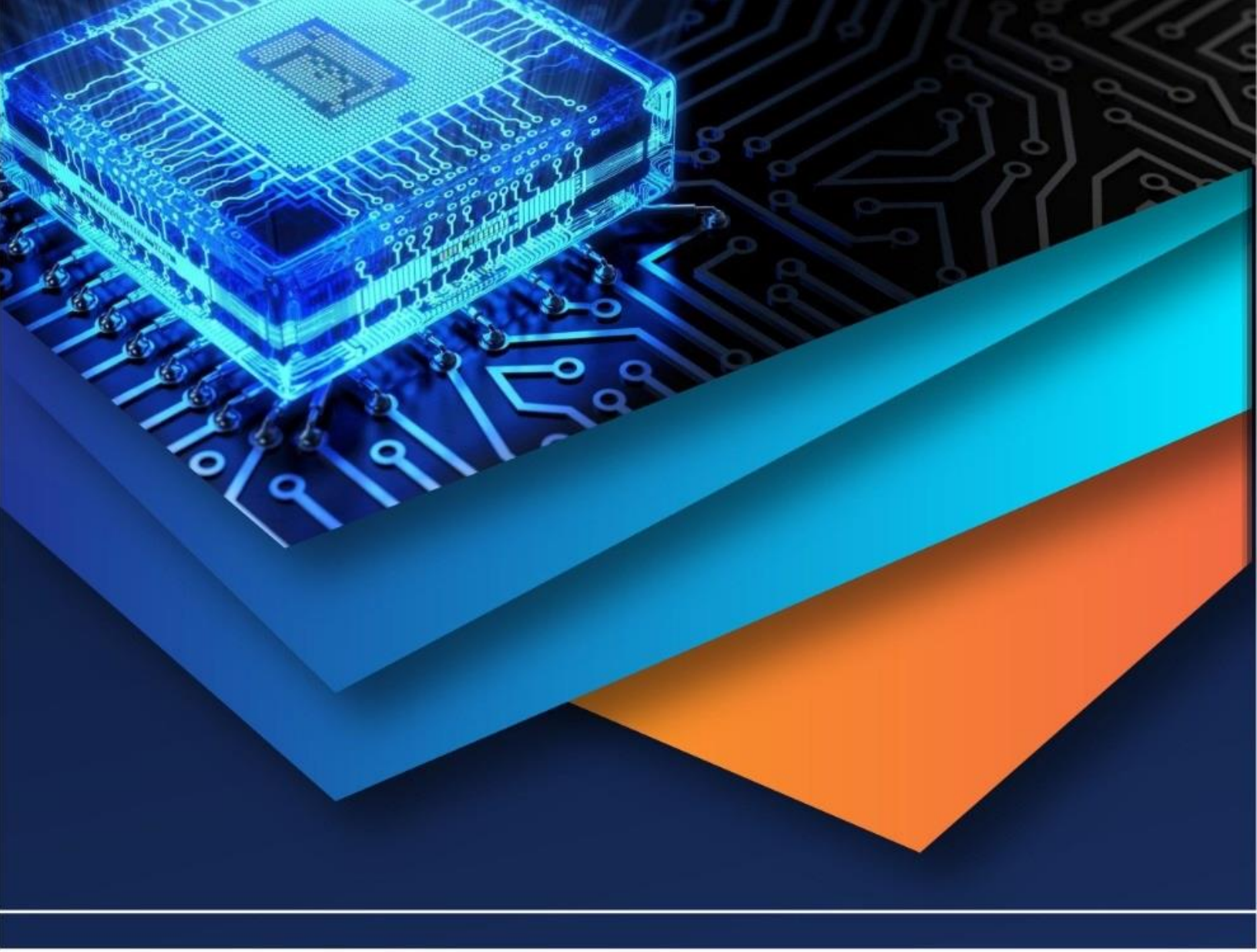
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